

Seasonal Winter Forecasts of the Northern Stratosphere and Troposphere: Results from JMA Seasonal Hindcast Experiments

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This presentation will discuss winter forecasts of the Northern stratosphere and troposphere using seasonal hindcast (HC) experiments of the Japan Meteorological Agency (JMA). A main focus is placed on the seasonal forecasts of the Northern Annular Mode (NAM) and major stratospheric sudden warmings (MSSWs) during DJF, when the forecasts are initialized in late fall.

Results demonstrate that the HC data have significant skill for both ensemble-mean and category (probability) forecasts of the DJF-mean NAM only in the stratosphere, whereas they do not in the troposphere. The forecast skill of the stratospheric NAM changes with the observed phase of the Quasi-Biennial Oscillation (QBO), although the QBO is not simulated but is only included in initial conditions and decays with time. The skill is higher for the easterly phase, characterized by hits of negative NAM states (weaker-than-normal polar vortex), whereas it is lower for the westerly phase, reflecting misses of positive NAM states. These suggest differences in the degree to which the HC data can capture Northern extratropical teleconnections between the two QBO phases.

Probability forecasts for the MSSW occurrence during DJF are also suggested to be significant (higher probabilities for actual MSSW years) near the 90% confidence level, although the modeled polar night jet is stronger than observed, and the modeled MSSW frequency is lower. It will be useful to examine seasonal forecasts of MSSW occurrence when modeled MSSW frequency is comparable to observations.

It is finally shown that a verification score for category forecasts of the stratospheric and tropospheric NAM tends to covary as a whole. The tropospheric forecast skill is significant when the stratosphere has large NAM anomalies in the real world and they are well forecasted. In contrast, the tropospheric forecasts are sometimes poor when the stratospheric forecasts fail to capture observed NAM conditions. It is speculated that stratospheric and tropospheric forecasts could be improved together through the stratosphere–troposphere coupling for such cases, that is, by successfully forecasting anomalous vortex states in the stratosphere. Such anomalous stratospheric states will be partly affected by external conditions such as the QBO.

Key words: seasonal winter forecasts, JMA hindcasts, NAM, MSSW, QBO

References

Taguchi, M., 2018: J. Atmos. Sci., **75**, 827-840.